CLAIMS

1. A method for filtering a digital input signal to produce a digital output signal, the method comprising steps of:

(A) reducing a resolution of the digital input signal to produce a reduced resolution signal;

(B) performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal; and

(C) performing interpolation on the reduced resolution signal to produce the digital output signal.

2. The method of claim 1, wherein the step (A) comprises steps of:

(A)(1) performing linear filtering on the digital input signal to produce a filtered digital input signal; and

(A)(2) down-sampling the filtered digital input signal to produce the reduced resolution signal.

3. The method of claim 2, wherein the step (A)(1) comprises a step of performing linear low-pass filtering on the digital input signal.

4. The method of claim 3, wherein the step of performing linear low-pass filtering on the digital input signal comprises a step of performing mean filtering on the digital input signal.

5. The method of claim 1, wherein the step (C) comprises steps of:

(C)(1) up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

(C)(2) performing linear low-pass filtering on the up-sampled filtered signal to produce the digital output signal.

6. The method of claim 5, wherein the step (C)(2) comprises a step of performing low-pass filtering using a linear low-pass filter for use in bi-cubic interpolation to produce the digital output signal.

7. A method for filtering a digital input signal to produce a digital output signal, the method comprising steps of:

(A) performing linear filtering on the digital input signal to produce a filtered digital input signal;

(B) down-sampling the filtered digital input signal to produce a reduced resolution signal;

(C) performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal;

(D) up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

(E) performing low-pass linear filtering on the up-sampled filtered signal to produce the digital output signal.

8. The method of claim 7, wherein the step (B) comprises a step of:

(B)(1) down-sampling the filtered digital input signal by a down-sampling factor to produce the reduced resolution signal;

wherein the step (D) comprises a step of:

(D)(1) up-sampling the filtered reduced resolution signal by an up-sampling factor to produce the up-sampled filtered signal; and

wherein the up-sampling factor and the down-sampling factor are equal.

9. The method of claim 8, wherein the step (A) comprises a step of:

(A) performing linear filtering with a rectangular impulse response of length *dec* on the digital input signal to produce the filtered digital input signal; and

wherein *dec* is equal to the down-sampling factor and to the up-sampling factor.

10. The method of claim 9, wherein the step (E) comprises a step of:

(E)(1) performing low-pass linear filtering with a support of length *dec* on the up-sampled filtered signal to produce the digital output signal.

11. The method of claim 1, wherein the digital input signal comprises a signal corresponding to a chrominance channel of a digital image.

12. The method of claim 1, wherein the digital input signal comprises a two-dimensional signal.

13. A method for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the method comprising steps of:

(A) filtering the first chrominance signal of the first digital image according to the method of claim 1 to produce the first filtered chrominance signal; and

(B) filtering the second chrominance signal of the first digital image according to the method of claim 1 to produce the second filtered chrominance signal.

14. The method of claim 13, wherein the first digital image is encoded according to a first color space, and wherein the method further comprises a step of:

(C) converting a third digital image encoded according to a second color space into the first digital image.

15. The method of claim 14, wherein the first color space comprises a luminance-chrominance color space, and wherein the second color space comprises an RGB color space.

16. The method of claim 15, wherein the step (C) comprises steps of:

(C)(1) subtracting a green color signal of the third digital image from a red color signal of the third digital image to produce the first chrominance signal of the first digital image;

(C)(2) subtracting the green color signal of the third digital image from a blue color signal of the third digital image to produce the second chrominance signal of the first digital image; and

(C)(3) providing the green color signal as the luminance signal of the first digital image.

17. The method of claim 14, further comprising a step of:

(D) converting the second digital image into a fourth digital image encoded according to a third color space.

18. The method of claim 17, wherein the first color space comprises a luminance-chrominance color space, and wherein the third color space comprises an RGB color space.

19. The method of claim 18, wherein the step (D) comprises steps of:

(D)(1) adding the first filtered chrominance signal to the luminance signal to produce a red color signal of the fourth digital image;

(D)(2) adding the second filtered chrominance signal to the luminance signal to produce a blue color signal of the fourth digital image; and

(D)(3) providing the luminance signal as a green color signal of the fourth digital image.

20. A multi-resolution filter comprising:

a resolution reduction filter to produce a reduced resolution signal by reducing the resolution of a digital input signal;

a median filter to produce a filtered reduced resolution signal by filtering the reduced resolution signal; and

an interpolation filter to produce a digital output signal by interpolating the filtered reduced resolution signal.

21. The multi-resolution filter of claim 20, wherein the resolution reduction filter comprises:

a linear filter to produce a filtered digital input signal by filtering the digital input signal; and

a down-sampler to produce the reduced resolution signal by down-sampling the filtered digital input signal.

22. The multi-resolution filter of claim 21, wherein the linear filter comprises a linear low-pass filter.

23. The multi-resolution filter of claim 22, wherein the linear low-pass filter comprises a mean filter.

24. The multi-resolution filter of claim 20, wherein the interpolation filter comprises:

an up-sampler to produce an up-sampled filtered signal by up-sampling the filtered reduced resolution signal; and

a linear low-pass filter to produce the digital output signal by filtering the up-sampled filtered signal.

25. The multi-resolution filter of claim 24, wherein the linear low-pass filter comprises a low-pass filter used in bi-cubic interpolation.

26. A multi-resolution filter for filtering a digital input signal to produce a digital output signal, the multi-resolution filter comprising:

a linear filter to produce a filtered digital input signal by filtering the digital input signal;

a down-sampler to produce the reduced resolution signal by down-sampling the filtered digital input signal;

a median filter to produce a filtered reduced resolution signal by filtering the reduced resolution signal;

an up-sampler to produce an up-sampled filtered signal by up-sampling the filtered reduced resolution signal; and

a linear low-pass filter to produce the digital output signal by filtering the up-sampled filtered signal.

27. The multi-resolution filter of claim 26, wherein the down-sampler has a down-sampling factor that is equal to an up-sampling factor of the up-sampler.

28. The multi-resolution filter of claim 27, wherein the linear filter has a support that is equal to the down-sampling factor and the up-sampling factor.

29. The multi-resolution filter of claim 28, wherein the linear low-pass filter has a support that is equal to the down-sampling factor and the up-sampling factor.

30. A multi-resolution filtering system for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the multi-resolution filtering system comprising:

a first multi-resolution filter according to claim 18 to produce the first filtered chrominance signal by filtering the first chrominance signal of the first digital image; and

a second multi-resolution filter according to claim 18 to produce the second filtered chrominance signal by filtering the second chrominance signal of the first digital image.

31. The multi-resolution filtering system of claim 30, wherein the first digital image is encoded according to a first color space, and wherein the multi-resolution filtering system further comprises:

a first color converter to convert a third digital image encoded according to a second color space into the first digital image.

32. The multi-resolution filtering system of claim 31, wherein the first color converter comprises:

a first subtractor to develop the first chrominance signal by subtracting a green color signal of the third digital image from a red color signal of the third digital image; and

a second subtractor to develop the second chrominance signal by subtracting the green color signal of the third digital image from a blue color signal of the third digital image.

33. The multi-resolution filtering system of claim 31, further comprising:

a second color converter to convert the second digital image into a fourth digital image encoded according to a third color space.

34. The multi-resolution filtering system of claim 33, wherein the second color converter comprises:

a first adder to develop a red color signal of the fourth digital image by adding the first filtered chrominance signal to the luminance signal of the second digital image; and

a second adder to develop a blue color signal of the fourth digital image by adding the second filtered chrominance signal to the luminance signal of the second digital image.

35. An apparatus for filtering a digital input signal to produce a digital output signal, the apparatus comprising:

resolution reduction means for reducing a resolution of the digital input signal to produce a reduced resolution signal;

median filtering means for performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal; and

interpolation means for performing interpolation on the reduced resolution signal to produce the digital output signal.

36. The apparatus of claim 35, wherein the resolution reduction means comprises:

means for performing linear filtering on the digital input signal to produce a filtered digital input signal; and

means for down-sampling the filtered digital input signal to produce the reduced resolution signal.

37. The apparatus of claim 36, wherein the means for performing linear filtering comprises means for performing linear low-pass filtering on the digital input signal.

38. The apparatus of claim 37, wherein the means for performing linear low-pass filtering comprises means for performing mean filtering on the digital input signal.

39. The apparatus of claim 35, wherein the interpolation means comprises:

up-sampling means for up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

means for performing linear low-pass filtering on the filtered signal to produce the digital output signal.

40. The apparatus of claim 39, wherein the means for performing linear low-pass filtering comprises means for performing low-pass filtering employed in bi-cubic interpolation on the up-sampled filtered signal to produce the digital output signal.

41. An apparatus for filtering a digital input signal to produce a digital output signal, the apparatus comprising steps of:

means for performing linear filtering on the digital input signal to produce a filtered digital input signal;

means for down-sampling the filtered digital input signal to produce a reduced resolution signal;

means for performing median filtering on the reduced resolution signal to produce a filtered reduced resolution signal;

means for up-sampling the filtered reduced resolution signal to produce an up-sampled filtered signal; and

means for performing low-pass linear filtering on the up-sampled filtered signal to produce the digital output signal.

42. The apparatus of claim 41, wherein the means for down-sampling comprises means for down-sampling the filtered digital input signal by a down-sampling factor to produce the reduced resolution signal, wherein the means for up-sampling comprises means for up-sampling the filtered reduced resolution signal by an up-sampling factor to produce the up-sampled filtered signal, and wherein the up-sampling factor and the down-sampling factor are equal.

43. The apparatus of claim 42, wherein the means for performing linear filtering comprises means for performing linear filtering with a rectangular impulse response of length *dec* on the digital input signal to produce the filtered digital input signal, and wherein *dec* is equal to the down-sampling factor and to the up-sampling factor.

44. The apparatus of claim 43, wherein the means for performing low-pass linear filtering comprises means for performing low-pass linear filtering with a support of length *dec* on the up-sampled filtered signal to produce the digital output signal.

45. An apparatus for producing a second digital image from a first digital image, the first digital image including a luminance signal, a first chrominance signal, and a second chrominance signal, the second digital image including the luminance signal, a first filtered chrominance signal, and a second filtered chrominance signal, the apparatus comprising:

means for filtering the first chrominance signal of the first digital image according to the method of claim 1 to produce the first filtered chrominance signal; and

means for filtering the second chrominance signal of the first digital image according to the method of claim 1 to produce the second filtered chrominance signal.

46. The apparatus of claim 45, wherein the first digital image is encoded according to a first color space, and wherein the apparatus further comprises:

means for converting a third digital image encoded according to a second color space into the first digital image.

47. The apparatus of claim 46, wherein the means for converting comprises:

means for subtracting a green color signal of the third digital image from a red color signal of the third digital image to produce the first chrominance signal;

means for subtracting the green color signal of the third digital image from a blue color signal of the third digital image to produce the second chrominance signal; and

means for providing the green color signal as the luminance signal.

48. The apparatus of claim 45, further comprising:

means for converting the second digital image into a fourth digital image encoded according to a third color space.

49. The apparatus of claim 48, wherein the means for converting comprises:

means for adding the first filtered chrominance signal to the luminance signal of the second digital image to produce a red color signal of the fourth digital image;

means for adding the second filtered chrominance signal to the luminance signal of the second digital image to produce a blue color signal of the fourth digital image; and

means for providing the luminance signal of the second digital image as a green color signal of the fourth digital image.